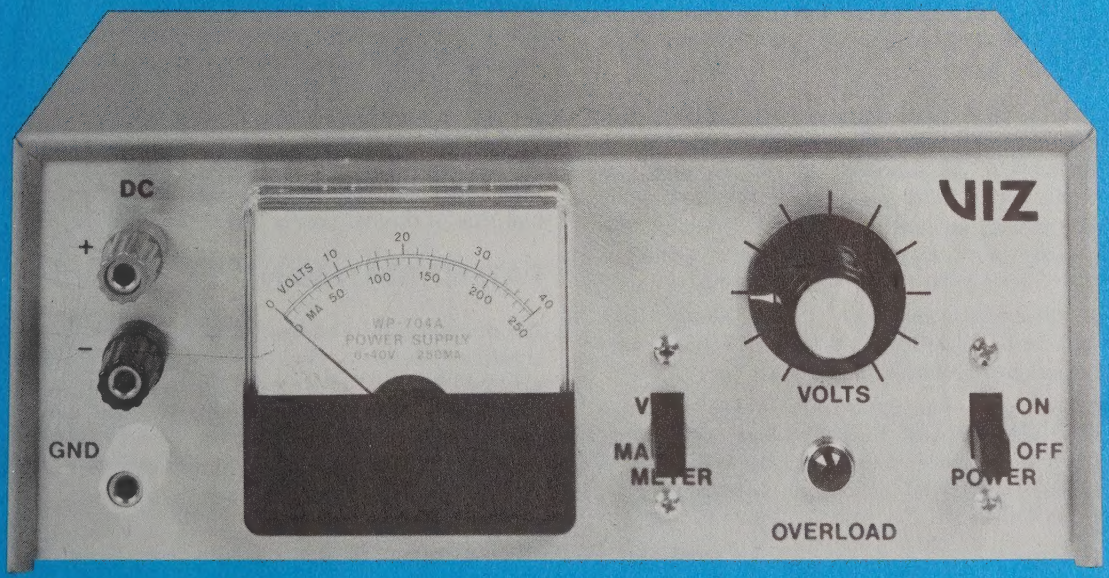
Instruction Manual for

Power Supplies

WP-703A and WP-704A



VIZ Electronic Instruments

VIZ Mfg. Co., 335 E. Price St., Phila., Pa. 19144

Price $1.50

Printed in U.S.A.

Safety Precautions

Certain safety precautions should be observed when the power supply is used with external circuits that are connected to the AC power line. There is always danger inherent in working with electrical equipment or circuits that operate at hazardous voltages. You should thoroughly familiarize yourself with the equipment before working on it, bearing in mind that high voltages may appear at unexpected points in defective equipment. Important safety precautions are listed below:

1. This instrument is equipped with a three-wire power cord which connects the metal case and ground terminal to the power-line ground. To prevent lethal shocks or equipment damage when using the Power Supply with equipment not equipped with a three-wire power cord, ALWAYS ELECTRICALLY ISOLATE SUCH EQUIPMENT WITH AN ISOLATION TRANSFORMER, such as VIZ WP-25A*, WP-26A*, or WP-27A Isotap.

2. It is good practice to remove power before connecting test leads to high-voltage points. If this is impractical, be *especially careful* to avoid accidental contact with equipment racks and other objects which can provide a ground. Working with one hand in your pocket and standing on a properly insulated floor lessens the danger of shock.

3. Filter capacitors may store a charge large enough to be hazardous. Therefore, discharge filter capacitors before attaching test leads.

4. Remember that leads with broken insulation provide the additional hazard of high voltages appearing at exposed points along the leads. Check test leads for frayed or broken insulation before working with them.

5. To lessen the danger of accidental shock, disconnect test leads immediately after test is completed.

6. Remember that the risk of severe shock is only one of the possible hazards. Even a minor shock can place the operator in hazard of more serious risks such as a bad fall or contact with a source of higher voltage.

7. The experienced operator continuously guards against injury and does not work on hazardous circuits unless another person is available to assist in case of accident.

Be careful whenever testing electrical equipment that is operating from an AC power line or other high voltage source. There is always the danger of electrical shock from these circuits. You should become familiar with the equipment before making tests. Keep in mind that voltages may appear at unexpected points in defective equipment.

It is good practice to remove power before connecting test leads to high voltage points. When measuring high AC or DC voltages, do not touch the panel or test leads. Also, it is important to use an isolation transformer such as the VIZ WP-25A, WP-26A, or WP-27A Isotap when working with AC/DC equipment where the chasis is connected to one side of the AC power line.

PATENT STATEMENT

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* Use isolated sockets only.

AVAILABLE SEPARATELY

Dual banana plug and leads. Includes alligator clip connectors . . . WG-413A

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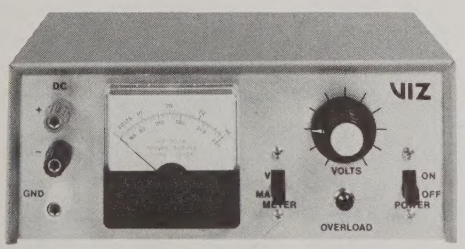


Description

The WP-703A and WP-704A are solid-state constant voltage dc power supplies. These versatile bench-type supplies are ideally suited for use in circuit design, servicing, industrial and educational applications.

Output voltage of the WP-703A is continuously adjustable from 0 to 20 volts at current levels up to 500 milliamperes. The output voltage of the WP-704A is adjustable from 0 to 40 volts at current levels up to 250 mA.

Overload current is limited to prevent damage to the power supplies. No damage will occur even if connected to an external short circuit. A special overload indicator panel lamp will begin to glow when the current approaches the maximum rated level.

A meter is provided to indicate either output voltage or current level. The meter function is selected by a convenient panel switch.

All silicon transistors and diodes are used in the WP-703A and WP-704A. Circuit design features include a negative feedback circuit to maintain constant output voltage with low ripple regardless of varying line voltage or load resistance.

Three convenient five-way output terminals (+DC, —DC, and GND) are provided. The units are equipped with a three-wire ac power cord to permit connecting the external circuit to the power line ground, using the "GND" terminal.

The WP-703A and WP-704A are compact and lightweight, with attractively designed functional panels. The units measure 5¼ inches by 8¼ inches by 3¼ inches.

Specifications

	WP-703A	WP-704A
Output	0 to 20V 0 to 500 mA	0 to 40V 0 to 250 mA
Line Regulation (Max. change in output level with power-line variation of 110 to 135 V ac)	7 mV	15 mV
Load Regulation	less than 10 mV change for a 500 mA load change	less than 20 mV change for 250 mA load change
Ripple	less than 200 μV rms	less than 500 μV rms
Meter Functions (Function selected with panel switch)	0 to 20V 0 to 500 mA	0 to 40V 0 to 250 mA

Controls ..... Continuously variable voltage adjustment
Power on/off
Meter selector V/mA

Output Terminals ..... DC+, DC—, GND. (Pos. or neg. output)

Short Circuit Protection ..... Protected from damage due to external short circuit

Overload Indicator ..... Panel lamp glows when current approaches max. level

Power Requirements ..... 110 to 135V, 50-60 Hz

Power Cord ..... three-wire type

Dimensions ..... 5¼ in. x 8¼ in. x 3¼ in.

Weight ..... 3 pounds, 13 ounces.

Operation

1. Plug power cord in 120 volt, 50-60 Hz outlet. To turn power on, set POWER switch to the "ON" position.

2. Set "V/MA" switch to "V". Select desired voltage with VOLTS ADJUST control. Voltage will be indicated on upper meter scale.

3. Connect external load positive lead to "DC+" output terminal, and negative to "DC—" terminal. See Figures 1A and 1B showing connections for positive or negative ground connections. If more than one external load is to be used, connect separate wires from each device to the output terminals. This will minimize cross-coupling and provide best load regulation. Use leads as short as possible for all connections.

4. Set V/MA switch to "MA". Current level will be indicated on the lower meter scale.

Note: As current level approaches the maximum rated level, the OVERLOAD lamp will begin to glow. If the current level does exceed the maximum rating, the lamp will glow brightly, and the output voltage will decrease. Use meter to check current and voltage level.

Grounding

The Power Supply GND terminal is connected to the ac power line ground through the 3-wire power cord. In most applications, the load circuit ground, whether it is positive or negative, should be connected to the GND terminal. Use a short jumper wire between the "—DC" and "GND" terminals for negative ground, and between the "+DC" and "GND" terminals for positive ground. See Figure 1.

Floating Ground

In some applications, such as bridge circuits, no ground connection is made so that the entire circuit is "floated". The common section of these circuits usually has an above-ground dc potential. Do not connect the power supply to a circuit that is more than 100 volts above ground. If other supply voltages are connected to the load circuit, check the voltage from the power supply ground to the positive or negative points in the circuit to be sure this voltage does not exceed 100 volts.

Connecting Power Supplies In Series

Two or more power supplies can be connected in series to provide higher voltage. See Figure 2. The output voltage will be the sum of the voltage from the individual supplies. Each supply can be adjusted as required to obtain the desired total voltage. Note that the maximum current available is the same as if only one supply is used.

Caution:

When supplies are connected in series, a diode should be connected across the output terminals of each supply to protect them from possible damage should one of the supplies inadvertantly be turned off. Use a 1N3254, or similar diode with at least a ½ ampere, 50 volt rating.

Note: It is not recommended that WP-703A and WP-704A Power Supplies be connected in parallel.

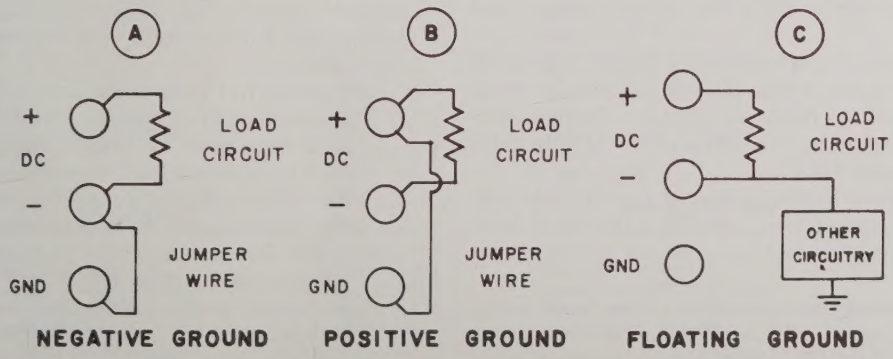


Figure 1. Power Supply Ground Connections.

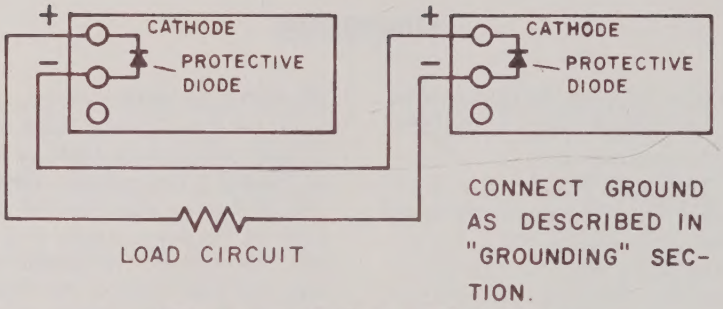


Figure 2. Connecting Power Supplies in Series.

Circuit Description

The WP-703A and WP-704A are solid-state, constant voltage dc power supplies. The WP-703A provides 0 to 20 volts at 500 mA, and the WP-704A provides 0 to 40 volts at 250 mA. Except for a few components however, the circuit of these two supplies are quite similar. The following circuit description applies to both units.

The ac line voltage input is reduced to a lower ac voltage through the power transformer, then rectified by diodes CR1 and CR2.

The series regulator transistors, Q1 and Q4, the driver transistor, Q2, and the comparison amplifier transistor, Q3 form a high-gain negative feedback amplifier circuit providing constant output voltage level.

Diode CR3 provides a fixed reference voltage, regulated by zener diodes CR4, CR5, and CR7. This reference voltage and the negative output voltage are applied to the comparison amplifier through the voltage divider formed by resistors R6 and R7, the VOLTS ADJUST control. As variations in the output voltage occur, the comparison amplifier applies a correction voltage through the driver circuit to the series regulator, keeping the output voltage level constant.

Transistor Q5 acts as a current limiting device. At excessive current levels, Q5 will conduct, diverting the current from the series regulator. Current limiting is improved by the action of the OVERLOAD indicator lamp, DS-1.

The current limiting action of these circuits prevents the current from exceeding the rated level, even if a short circuit is connected to the output terminals.

The metering circuit consists of the 2 mA meter, calibrating resistors R9 and R10, and the slide switch S1, which is used to select voltage or current measuring function.

Anti-Static Meter Coating

The clear meter cover of this instrument has been coated with a special anti-static solution to prevent static effects on the action of the pointer. Eventually this coating may lose its effectiveness, and a static charge will build up on the meter case causing the pointer to act erratically. You can check this anti-static characteristic by rubbing the meter cover with a clean soft cloth. If the anti-static coating is no longer effective, the meter pointer will move off zero and remain there for several minutes.

If necessary, a new coat of anti-static solution should be applied to the outside of the meter "window". A small bottle of this solution can be purchased from most local electronic distributors.

Viz Repair Service

Authorized VIZ Service Depots throughout the United States are available for repair and calibration of VIZ Electronic Instruments. For up-to-date listings of these depots, contact your VIZ Distributor, or write to VIZ, Electronic Instruments, 335 E. Price St., Phila. Pa., 19144. If it becomes necessary to service this equipment, fill out the Test Equipment Service order form supplied with the instructions:

1. Pack the test equipment carefully. The instrument should be double-packed. It is best to pack the unit in its original carton, or similar container, then "float" this carton in at least a 3-inch layer of suitable packing, such as shredded paper, inside the outer carton.
2. A full description of the problem should be included in the request.
3. Include all probes, cables, and test leads used with equipment.

Attention to these details will help prevent damage in transit and delay in repairs.

Replacement Parts List

WP-703A

SYMBOL NO	DESCRIPTION	PART NO
	CAPACITORS	
C1	Electrolytic, 1000μF, 50v	9603-102
C2	Electrolytic, 30μF, 50v	9603-106
C3	Electrolytic, 2μF, 30v	9602-103
C4	Electrolytic, 50μF, 30v	9603-108
C5	Ceramic, 470pF, 500v	9512-022
C6	Ceramic, .01μF, 1000v, GMV	9327-133
	RESISTORS	
R1	Wirewound, 1.3 ohms, 5%, 3w	16-900039
R2	680 ohms, 10%, 1/2w	16-086811
R3	Wirewound, 1200 ohms, 5%, 3w	9602-111
R4	1000 ohms, 5%, 1/2w	16-081021
R5	1800 ohms, 10%, 1/2w	16-081821
R6	Film, 4000 ohms, 1%, 1/4w	16-900038
R7	Variable, 20,000 ohms	9602-025
R8	180 ohms, 10%, 1/2w	16-081511
R9	Variable, Carbon, 100 ohms, 20%	9603-103
R10	Variable, Carbon, 5000 ohms, 20%	1392-046
R11	8,200 ohms, 10%, 1/2w	16-088221
R12	390 ohms, 10%, 1/2w	16-083911
R13	Wirewound, 4 ohms	16-900040
R14	Variable, Wirewound, 10ohms, 20%	9603-105
R15	470 ohms, 5%, 1/2w	16-084911
	DIODES	
CR1	Diode—Type 1N4007	11-040071
CR2	Diode—Type 1N4007	11-040071
CR3	Diode—Type 1N4007	11-040071
CR4	Diode—Type 1N962B	11-096200
CR5	Diode—Type 1N706A	11-070600
CR6	Diode—Type 1N4148	11-041481
CR7	Diode—Type 1N965B	11-096500
	TRANSISTORS	
Q1	Transistor—Type 2N2102	12-021020
Q2	Transistor—Type 2N4036	12-040360
Q3	Transistor—Type 2N3904	12-089040
Q4	Transistor—Type 2N3055	12-030550
Q5	Transistor—Type 2N5183	12-051830
	MISCELLANEOUS	
S1	Switch— Slide , DPDT, "ON/OFF"	9602-017
S2	Switch— Slide , DPDT, "V/MA"	9602-017
T1	Transformer—Power	9603-010
DS1	Lamp—Type No. 45	9602-051
J1	Post—Binding, Red	9200-126
J2	Post—Binding, Black	9200-127
J3	Post—Binding, White	9200-128
M1	Meter	9603-012
	Board—Circuit, Less Comp.	9603-101
	Chassis	9603-050
	Cover—Wrap	9451-125
	MISCELLANEOUS	
	Feet—Rubber	9404-004
	Knob	9200-181
	Power Cord—3 Wire	9415-026
	Socket for OVERLOAD Lamp	9604-013
	Washer—Fibre, No. 8, 6 per Stock-No.	9404-064
	Supports PC Board	9451-128

WP-704A

SYMBOL NO	DESCRIPTION	PART NO
	CAPACITORS	
C1	Electrolytic, 1000μF, 80v	9604-102
C2	Electrolytic, 20μF, 75v	9604-104
C3	Electrolytic, 2μF, 50v	9604-103
C4	Electrolytic, 30μF, 50v	9603-106
C5	Ceramic, 470pf, 500v	9512-022
C6	Ceramic, .01μF, 1000v, GMV	9327-133
	RESISTORS	
R1	Wirewound, 3 ohms, 5%, 3w	16-900041
R2	680 ohms, 10%, 1/2w	16-086811
R3	Wirewound, 2200 ohms, 5%, 3w	16-900042
R4	1000 ohms, 5%, 1/2w	16-081021
R5	1800 ohms, 10%, 1/2w	16-081821
R6	Film, 4000 ohms, 1%, 1/2w	16-900038
R7	Variable, 40,000 ohms	9604-025
R8	180 ohms, 10%, 1/2w	16-081511
R9	Variable, Carbon, 100 ohms, 20%	9603-103
R10	Variable, Carbon, 5000 ohms, 20%	1392-046
R11	18,000 ohms, 10%, 1/2w	16-081831
R12	390 ohms, 10%, 1/2w	16-083911
R13	Wirewound, 18 ohms, 5%, 3w	16-900043
R14	Wirewound, Variable, 10 ohms, 20%	9603-105
R15	470 ohms, 5%, 1/2w	16-084911
	DIODES	
CR1	Diode—Type 1N4007	11-040071
CR2	Diode—Type 1N4007	11-040071
CR3	Diode—Type 1N4007	11-040071
CR4	Diode—Type 1N962B	11-096200
CR5	Diode—Type 1N706A	11-070600
CR6	Diode—Type 1N4148	11-041481
CR7	Diode—Type 1N965B	11-096500
	TRANSISTORS	
Q1	Transistor—Type 2N5320	12-053200
Q2	Transistor—Type 2N5415	12-054150
Q3	Transistor—Type 2N3904	12-039040
Q4	Transistor—Type 2N6254	12-062540
Q5	Transistor—Type 2N5183	12-051830
	MISCELLANEOUS	
S1	Switch— Slide , DPDT, "ON/OFF"	9602-017
S2	Switch— Slide , DPDT, "V/MA"	9602-017
T1	Transformer—Power	9604-010
DS1	Lamp—Type No. 45	9602-051
J1	Post—Binding, Red	9200-126
J2	Post—Binding, Black	9200-127
J3	Post—Binding, White	9200-128
M1	Meter	9604-012
	Board—Circuit, Less Comp.	9603-101
	Chassis	9603-050
	Cover—Wrap	9451-125
	MISCELLANEOUS	
	Feet, rubber	9404-004
	Knob	9200-181
	Power Cord—3 Wire	9415-026
	Socket for OVERLOAD Lamp	9604-013
	Washer—Fibre, No. 8 Hole, 6 per Stock No.	9604-064
	Supports PC Board	9451-128

Maintenance

The WP-703A and WP-704A are tested and calibrated under careful engineering supervision. The units require no routine maintenance. There are two internal adjustments to calibrate the current and voltage readings of the meter. If it becomes necessary to replace any of the component parts, only VIZ replacement parts or their equivalent should be used. Order parts through an authorized VIZ Parts and Accessories Distributor.

This manual includes a schematic diagram for the WP-703A and WP-704A. Figure 3 shows the component location, including internal adjustments, for the circuit board used in both supplies.

Note: Measuring ripple and transient response characteristics of these power supplies requires laboratory-type test equipment, and should not be attempted unless such equipment is available.

To remove the case, take out the two screws on each side of the case, and the four screws on the bottom that fasten the feet to the unit.

Mechanical Zero Adjustment

The pointer should rest at "O" when the function switch is in the "OFF" position. If the pointer rests at an off-zero position, adjust the plastic screw on the front of the meter case so that the pointer lines up with the "O" point on the meter.

Adjusting Voltage Measurement

1. Connect a VTVM to the DC+ and DC— output terminals. Set VTVM to measure DC voltage. Turn on power supply. Set meter function switch to "V".

2. **WP-703A.** Turn VOLTS ADJUST control so that VTVM indicates 15 volts. Adjust potentiometer R10 so that power supply meter indicates 15 volts.

WP-704A. Turn VOLTS ADJUST control so that VTVM indicates 30 volts. Adjust potentiometer R10 so that power supply meter indicates 30 volts.

Adjusting Current Measurement

1. Connect an external load to power supply. Connect a VOM or other current measuring meter in series with the circuit load.

2. Turn on power supply. Set meter function switch to "MA".

WP-703A. Adjust VOLTS ADJUST control so that the current level indicated on the VOM is 350 MA. Adjust potentiometer R9 so that the power supply meter also indicates 350 MA.

WP-704A. Turn VOLTS ADJUST control so that the current level indicated on the VOM is 200 MA. Adjust potentiometer R9 so that the power supply meter also indicates 200 MA.

Adjusting Current Overload Level

Note: If potentiometer R14 has been replaced, set it to midrange before proceeding with this adjustment.

WP-703A

1. Connect a VOM or other current measuring instrument to the "DC+" and "DC—" terminals. Set VOM to 1 Amp or 10 Amp range.

2. Turn VOLTS ADJUST control fully clockwise. Adjust potentiometer R14 so that VOM indicates between 625 MA and 650 MA.

WP-704A

1. Connect a VOM or other current measuring instrument to the "DC+" and "DC—" terminals. Set VOM to 500 MA range.

2. Turn VOLTS ADJUST control fully clockwise. Adjust potentiometer R14 so that VOM indicates between 310 MA and 330 MA.

Note: The VOM acts as a short across the output of the power supply. The overload lamp will glow brightly.

Troubleshooting

Normal troubleshooting techniques can be used to locate defective components in the WP-703A and WP-704A. Reference voltages are given on the schematic diagram. An in-circuit transistor tester, such as the VIZ WT-501A, can be used to check the semiconductor components. The small-signal diodes, CR4, CR5 and CR6 must be removed from the circuit to be tested.

No Output

If the supply has no output, or if output is very low, check the voltage at output of diodes CR1 and CR2. See schematic diagram for voltage value.

If voltage is not correct, check CR1, CR2, the transformer, or the AC switch, S1.

If voltage at output of CR1 and CR2 is normal, check all diodes (expect CR1 and CR2), transistors, and the overload lamp.

Note: To check overload lamp, remove lamp from its socket. Measure internal resistance of the lamp using an ohmmeter. Resistance should be approximately 2 ohms.

High Output Voltage

If voltage becomes excessively high, do not turn VOLT ADJUST control to zero, this could cause further damage to the supply.

Check all transistors and diodes.

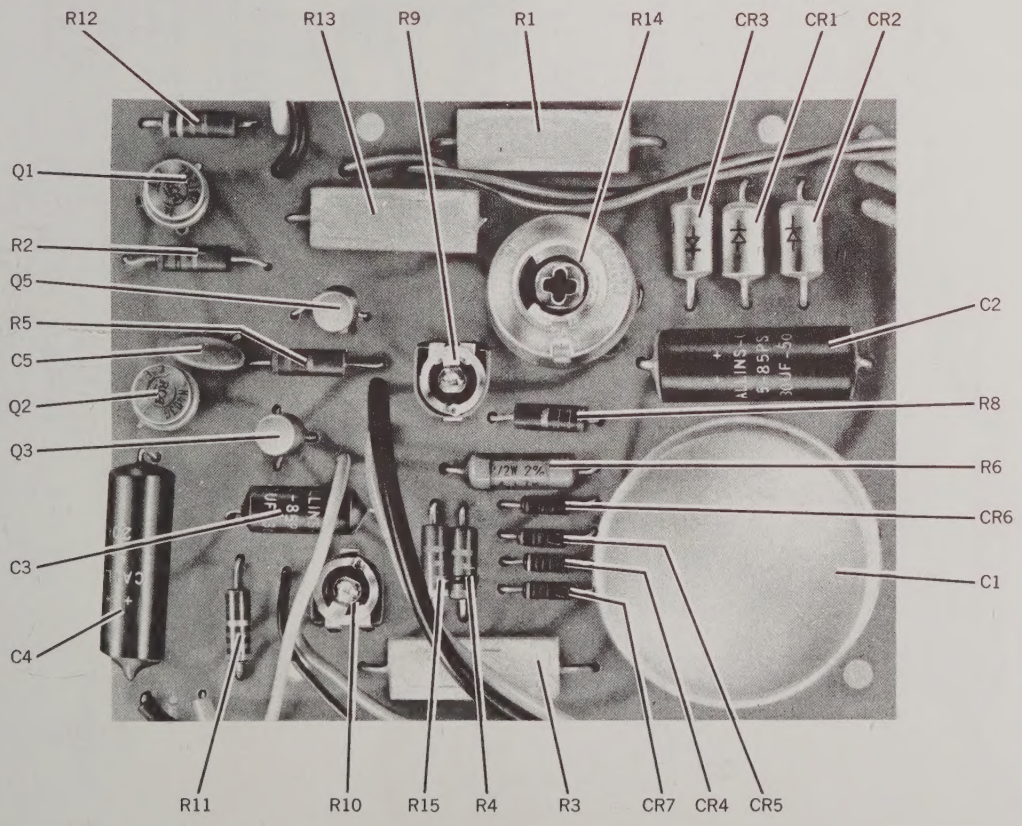
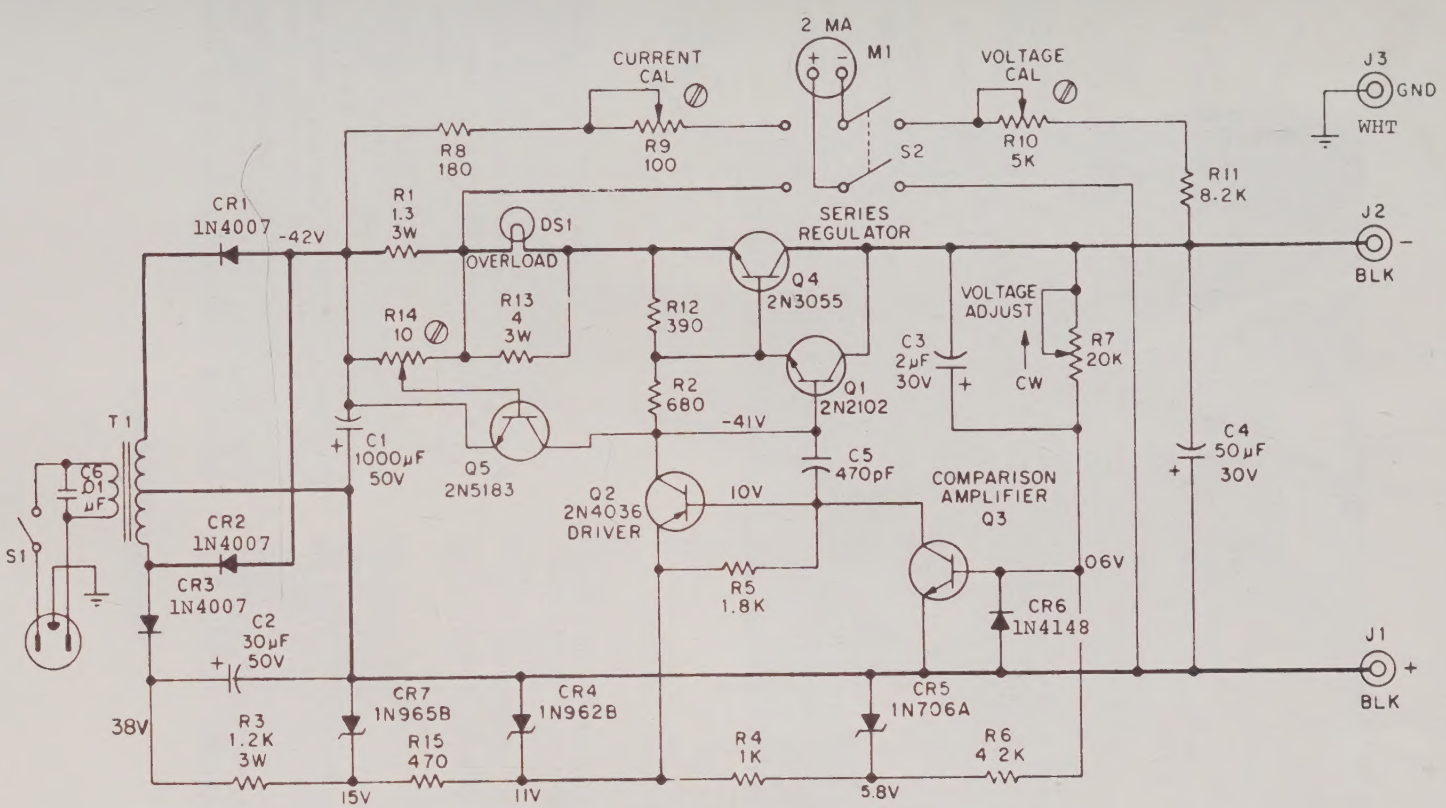


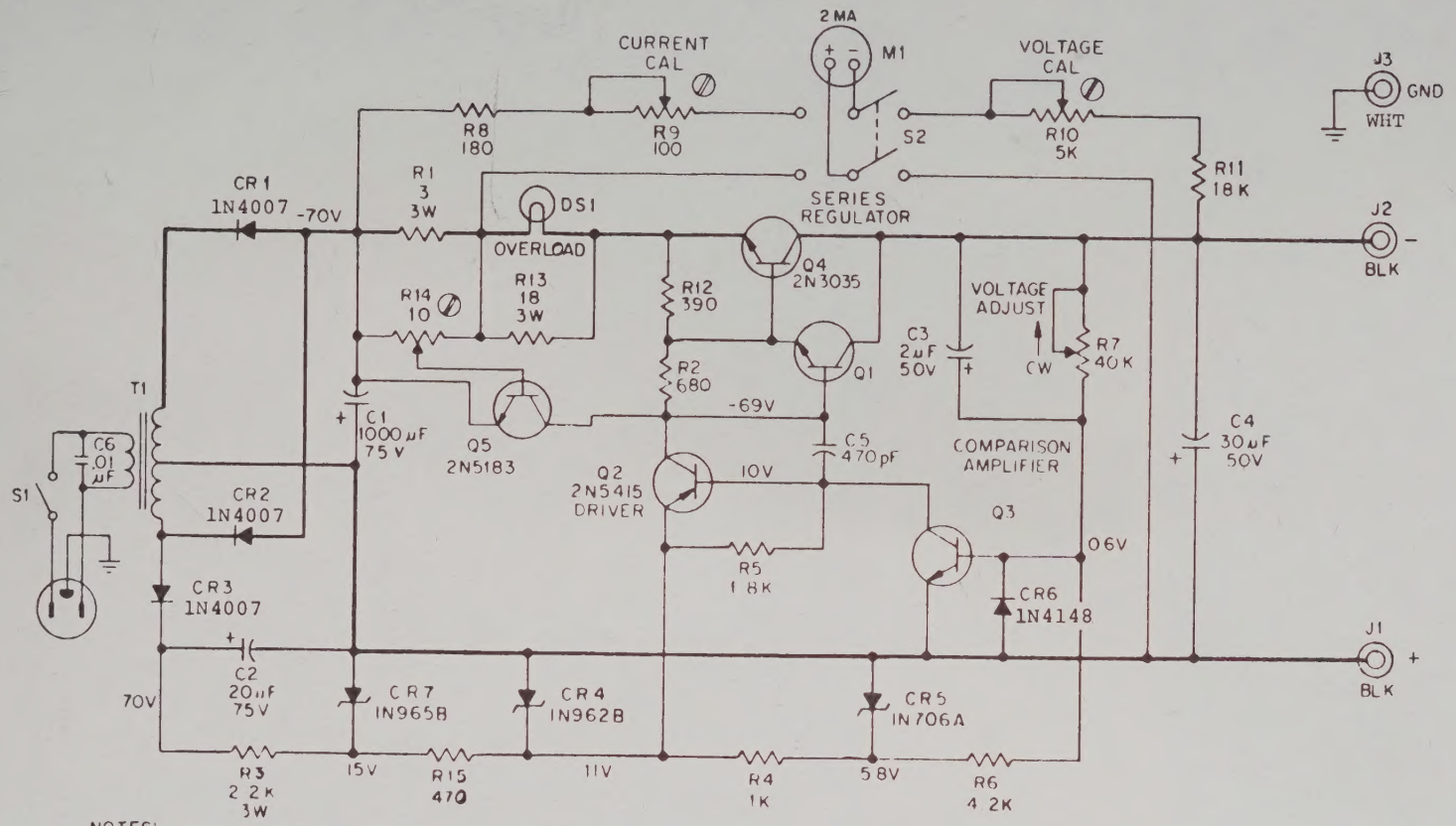
Figure 3. Location of components on Circuit Board.



NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE 1/2W 5%
2. ⊘ INDICATES SCREWDRIVER ADJUSTMENT
3. HEAVY LINES INDICATE MAIN CURRENT PATH
4. VOLTAGES MEASURED UNDER NO LOAD CONDITIONS, CONNECT GROUND LEAD OF VOLTMETER TO J1, THE RED "DC+" JACK. VOLTAGES MAY VARY ±20% INPUT VOLTAGE 120VAC 60HZ.

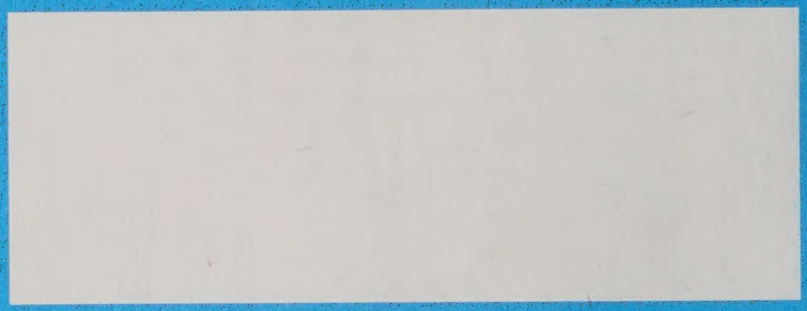
Figure 4. WP-703A Schematic Diagram.



NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE 1/2W ±5%
2. ⌀ INDICATES SCREWDRIVER ADJUSTMENT
3. VOLTAGES MEASURED UNDER NO LOAD CONDITIONS
   CONNECT GROUND LEAD OF VOLTMETER TO RED "DC +" JACK OF CIRCUIT UNDER TEST. VOLTAGES MAY VARY ±20%
4. HEAVY LINES INDICATE MAIN CURRENT PATH
   INPUT VOLTAGE 120V A.C., 60HZ

Figure 5. WP-704A Schematic Diagram.



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